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ABSTRACT

Reported is the National Science Foundation's research and development (R&D) economic standing. Discussed are the national R&D expenditures from 1968 through 1981, funds for R&D from 1975 through 1981, R&D gross national product from 1968 through 1981, national basic research, applied R&D expenditures from 1968 through 1981, and full-time equivalent R&D scientists and engineers by sector from 1968 through 1980. The topics listed were divided into different sectors which included federal government, industry, academic sector, and nonprofit organizations. (DS)

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SCIENCE RESOURCES STUDIES

HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION

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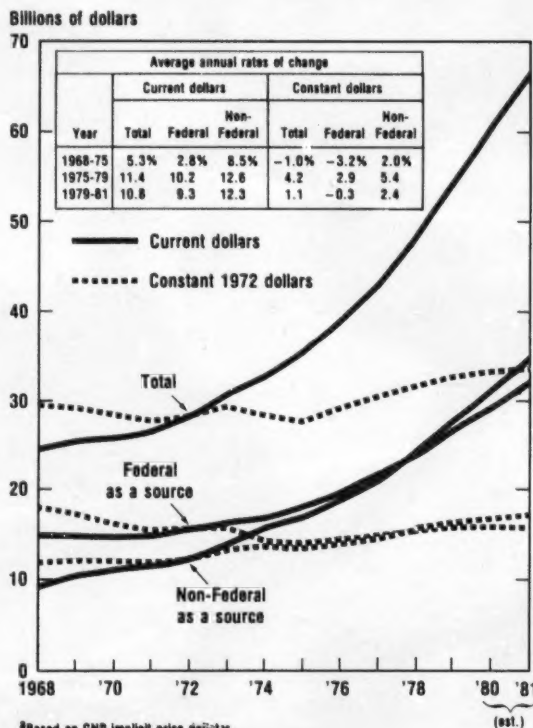
National R&D Spending Expected to Reach \$67 Billion in 1981

Highlights

- Even after the reductions in R&D programs contained in the Federal 1980 and 1981 budgets, U.S. R&D spending in 1981 is expected to follow the growth trend of the past five years, fueled to a large extent by the same forces that in 1976 ended the 10-year period of no growth in the Nation's real R&D investment—the search for means to resolve energy supply and utilization and environmental pollution problems and a resurgence of defense R&D activity.
- The estimated 1981 level of R&D expenditures—\$66.7 billion—is 11 percent higher than the expected 1980 level and is nearly double that of 1975 (chart 1). Constant-dollar gains in national R&D spending have occurred each year since 1975, averaging nearly 4 percent annually through 1979. The major indicators of the total R&D effort—constant dollar or real growth in R&D spending and the full-time-equivalent (FTE) number of scientists and engineers engaged in research and development—are expected to show little, if any, change in the level of R&D effort through 1981 as compared with 1979.
- Available data, analyses of Federal budget documents plus interview information from Government and private informed sources indicate that the gap between Federal and non-Federal R&D funding levels, although slight, is gradually but steadily widening. By 1979 the federally funded portion of national R&D expenditures had dropped from 65 percent in 1965 to 49 percent and is expected to drop another percentage point over the next two years, mainly as a result of expected increases in industry's own R&D funding.
- There will be no significant change in the ratio of defense-space R&D support to civilian-oriented R&D funds despite the sharp increase in Federal defense R&D outlays proposed for 1981, since civilian R&D funds—particularly industry's own funds (all of which are classified as civilian)—are also expected to show significant growth in 1981.

- There is likely to be continued stability in the relative amounts spent nationwide for research and for development as both activities are expected to increase at about the same rates during 1981. Since 1975 the ratio of research to development expenditures has remained at 1:2.
- Within the research total, however, proportionately more funds have been allocated to basic research—

Chart 1. National R&D expenditures



from 35 percent of the research total in 1975 to nearly 40 percent estimated for 1981. This is largely the result of recent administrations' policies of strengthening the Federal support of basic research which at present accounts for about two-thirds of the Nation's basic research expenditures.

- In both 1980 and 1981 national spending on research and development is expected to account for about the same 2.3 percentage of the Nation's gross national product (GNP) that has persisted since 1973. Based on R&D funding and GNP projections for the mideighties, this ratio should remain at about its present level into the near future.
- If the domestic scene is compared to the international picture, it is evident that the United States spends more than any other nation on R&D activities—at least twice the total amount spent by any other major Western country or Japan. Relative to GNP totals, U.S. expenditures for R&D activities are second to those of West Germany, with Japan a close third.
- The FTE number of R&D scientists and engineers employed in the United States continued the increases begun in the early seventies and is expected to reach a record level of nearly 660,000 in 1980. This is nearly 5 percent more than were employed a year earlier with all sectors sharing in the increase.

R&D Support

Real-term growth has occurred in the national R&D effort each year since 1975, primarily from Federal

energy and defense R&D increases as well as general industrial R&D growth. Although the temporal relationship between input and impact is not clearly understood, it is generally accepted that research and development eventually lead to economic gains and productivity increases. It is agreed, however, that the full economic impact of R&D spending is generally not realized in the short term and that the full effect of the recent constant-dollar R&D growth on the economy may not be felt for several years.

The Federal Government is expected to provide \$32.0 billion of R&D expenditures in 1981, nearly one-half of the total national effort. This ratio is down from the 65-percent figure prevalent during the midsixties before Federal defense and space R&D funds were reduced. Beginning in 1976 Federal R&D funding in real terms began to increase. The first signs of increase reflected the growing national emphasis on energy conservation and development. Based on data shown in "Special Analysis K" of the U.S. 1981 budget,¹ further Federal R&D increases are expected from a shift back toward defense and space activities in both 1980 and 1981.

In 1981 the Federal Government is expected to increase R&D spending by about 10 percent over 1980, remaining level in constant dollars, based on an unpublished estimate by the Office of Management and Budget of 10 percent for inflation in 1981. Between

¹Office of Management and Budget, "Special Analysis K," *The Budget of the United States Government, Fiscal Year 1981* (Washington, D.C.: U.S. Government Printing Office, 1980.)

Funds for research and development
(Dollars in millions)

Year	Total	Federal Government	Industry ¹	Academic sector		Other nonprofit institutions ¹
				Universities and colleges	Associated FFRDC's ²	
	By performer					
1975	\$35,256	\$5,397	\$24,187	\$3,406	\$987	\$1,276
1976	38,960	5,710	26,997	3,730	1,147	1,376
1977	43,013	6,142	29,928	4,064	1,384	1,495
1978	48,286	6,882	33,400	4,615	1,717	1,672
1979 (prelim.)	54,296	7,500	37,622	5,340	1,840	1,994
1980 (est.)	60,375	7,830	42,250	6,050	2,000	2,245
1981 (est.)	66,700	8,500	47,000	6,650	2,200	2,350
	By source					
1975	35,256	18,152	15,820	750	—	534
1976	38,960	19,844	17,694	821	—	601
1977	43,013	21,751	19,696	893	—	673
1978	48,286	24,058	22,433	1,029	—	766
1979 (prelim.)	54,296	26,762	25,520	1,150	—	864
1980 (est.)	60,375	29,400	28,710	1,300	—	965
1981 (est.)	66,700	32,000	32,210	1,450	—	1,040

¹Includes expenditures for federally funded research and development centers (FFRDC's) administered by this sector. They account for less than 5 percent and 15 percent, respectively, of the industry and nonprofit performance totals.

²FFRDC's administered by individual universities and colleges and by university consortia.

SOURCE: National Science Foundation.

1975 and 1979 constant-dollar Federal R&D support increased by nearly 15 percent. Non-Federal R&D support, on the other hand, has increased at an even faster rate since 1975—nearly 25 percent in real terms. Over 90 percent of the non-Federal R&D funds are provided by industry each year. The non-Federal growth resulted primarily from increased industry R&D spending over this entire period, much of which went for energy and environmental programs.

R&D/GNP

Total R&D expenditures are expected to account for 2.3 percent of the GNP in both 1980 and 1981 (chart 2). This ratio steadily declined from its 3-percent high in the mid-sixties to its present level by the mid-seventies where it has remained ever since. Chief contributory factors for this pattern have been the changing levels of Federal funding of defense and space projects and, in the most recent years, the growth of Government energy R&D programs. Excluding defense and space funding from the R&D totals, the resulting civilian R&D/GNP ratio is seen to remain relatively constant at about 1.5 percent between the mid-sixties and early seventies, but is expected to reach a high of 1.6 percent in 1980 and 1981.

Character of R&D Work

Total research spending in the United States is expected to reach a current-dollar level of about \$24 billion in 1981, an increase of 10 percent over the expected 1980 figure. Of this total, basic research will account for about \$9 billion, matching the 10-percent increase for total research expenditures. Basic research spending increased each year in real terms from 1975 to 1979, averaging 5 percent annually (chart 3). The Federal Government, which supports 70 percent of the Nation's basic research accounted for nearly 80 percent of the increase. Industry, which supports 15 percent of the basic research effort, accounted for most of the remainder by increasing its spending in this area 20 percent in real terms between 1975 and 1979. Based on discussions with industrial R&D directors during the latter half of 1979, industry's basic research support is likely to show real growth through 1981. This is in contrast to the 1966-75 period where industry basic research support declined by nearly 20 percent.

National applied research spending is expected to reach about \$15 billion in 1981, an increase of 10 percent over 1980. The real-term growth reported between 1975 and 1979 in applied research spending is projected to level off in 1980 and 1981. The 1975-79 growth has mainly been the result of increased industrial support which has increased by one-fourth primarily in energy-related areas. Federal support over the same period has increased by nearly 10 percent.

Chart 2. R&D/GNP

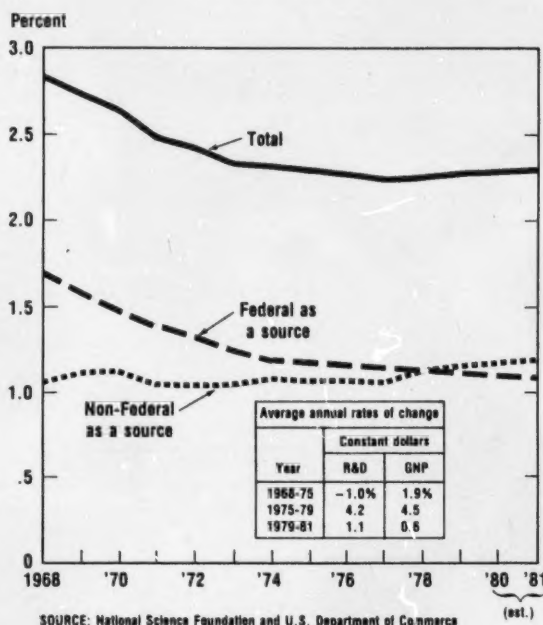
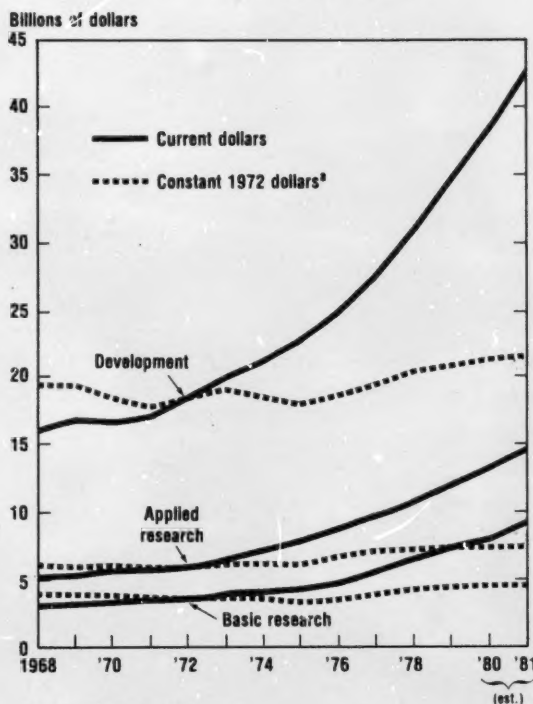


Chart 3. National basic research, applied research, and development expenditures

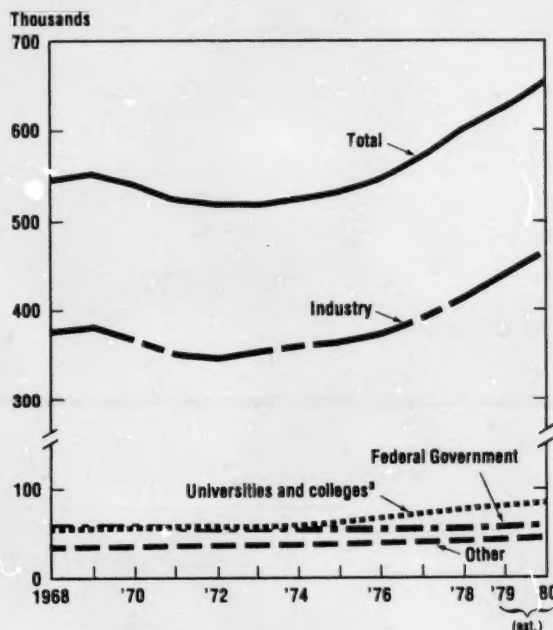


Development spending in 1981 is expected to reach approximately \$43 billion, 11 percent more than in 1980. Both industry and the Federal Government have been increasing their development support in real terms between 1975 and 1979—5 percent per year by industry and 2 percent by Government. This growth resulted primarily from the national emphasis on energy.

R&D Scientists and Engineers

There were 602,000 FTE R&D scientists and engineers engaged in R&D activities in 1978, 5 percent more than in 1977. The FTE number of these professionals has been increasing each year since 1972 when 518,000 were employed. It is expected that the employment of R&D scientists and engineers will continue to increase to about 660,000 in 1980. This number is based on the increases expected in real R&D spending between 1978 and 1980. All sectors of the economy are expected to share in the increase with the largest absolute growth to occur in industry, particularly in areas with a heavy reliance on engineering (chart 4).

Chart 4. Full-time-equivalent R&D scientists and engineers by sector



*Excludes associated FFRDC's.

SOURCE: National Science Foundation

National Science Foundation

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